Algebra 1-2
FACTORING POLYNOMIALS

Name: ______________________

IMPORTANT: **Always look to factor the GCF of all terms first**

# OF TERMS	FACTORING TECHNIQUE		EXAMPLE
2 or more	Greatest Common Factor (of all terms) "Reverse Distribution" → Divide out GCF, so GCF(+)		$3x^3 + 6x^2 - 15x =$ $3x(x^2 + 2x - 5)$
4 or more	Factoring by Grouping Parentheses or **"Box Method"**	$ax + bx + ay + by$ $= x(a + b) + y(a + b)$ $= (a + b)(x + y)$	$(3xy - 6y) - (5x + 10)$ $3y(x-2) - 5(x-2)$ $(3y-5)(x-2)$
2	Difference of Squares	$a^2 - b^2 = (a + b)(a - b)$ [Take square roots]	$\sqrt{4x^2} = 2x$ $\sqrt{25} = 5$ $4x^2 - 25 =$ $(2x+5)(2x-5)$
3	$x^2 + bx + c$ **"ac 7 b-Method"**	$x^2 + bx + c = (x + m)(x + n)$, when $m + n = b$ and $mn = c$ [factors of c]	$x^2 - 9x + 20 =$ $(x-4)(x-5)$ $ac = 1 \cdot 20 = 20$; -9 $-1, -20$ $-2, -10$ $-4, -5$; -9
3	$ax^2 + bx + c$ **"ac 7 b-method"** then grouping (or GCF shortcut)	$ax^2 + bx + c = ax^2 + mx + nx + c$, where $mn = ac$ and $m + n = b$. Then use factoring by grouping.	$6x^2 - x - 2 =$ $\dfrac{(6x-4)(6x+3)}{6}$ $2 \cdot 3$ $(3x-2)(2x+1)$ $ac = 6 \cdot -2 = -12$; -1 $-4, 3$; -1
3	Perfect Square Trinomial	$a^2 + 2ab + b^2 = (a + b)^2$ $a^2 - 2ab + b^2 = (a - b)^2$	$x^2 + 6x + 9 =$ $(x+3)^2$ $4x^2 - 4x + 1 =$ $(2x-1)^2$

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Graphic Organizers used to factor...

Box Method (Grouping – 4 terms)

$3xy - 6y - 5x + 10$

- Factor out GCF in each row and column
- Take out (-) if top of column or left of row

	x	-2
$3y$	$3xy$	$-6y$
-5	$-5x$	$+10$

7-Method (Trinomials): Always factor out *GCF first*, if able

[a = 1 Easy]

$x^2 - 9x + 20 = (x - 4)(x - 5)$

a = 1 **b =** -9 **c =** +20

ac = 20

-5, -4

b = -9

$(1)(20) = 20$ [ac]

$(-5) + (-4) = -9$ [b]

[a ≠ 1 Harder "Shortcut"]

$6x^2 - x - 2 = (6x - 4)(6x + 3)$

"ax" "ax"

ac = -12

-4, 3

b = -1

Divide by GCF

$(6x-4)(6x+3)$

2 · 3

$(3x-2)(2x+1)$

$(6)(-2) = -12$ [ac]

$(-4) + (3) = -1$ [b]

Steps to solve for x when polynomial = 0

1. Move all terms to one side of equation.
2. Factor out the GCF (if there is one).
3. Factor using any other applicable techniques
    a. i.e. $(x + m)(x + n) = 0$
4. Use **zero product property** so $x + m = 0$ and $x + n = 0$
5. Solve for x: $x = -m$ and $x = -n$

Example: $x^2 + 80 = 18x$